Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Expanding Flexible Use of the 3.7 to 4.2 GHz Band	)	GN Docket No. 18-122
	)	
Petition for Rulemaking to Amend and Modernize Parts 25 and 101 of the Commission's Rules to Authorize and Facilitate the Deployment of Licensed Point-to-Multipoint Fixed Wireless Broadband Service in the 3.7-4.2 GHz Band	)	RM-11791
	)	
Fixed Wireless Communications Coalition, Inc., Request for Modified Coordination Procedures in Band Shared Between the Fixed Service and the Fixed Satellite Service	)	RM-11778

COMMENTS OF T-MOBILE USA, INC.

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T-Mobile USA, Inc. ("T-Mobile")[1/] submits these comments in response to the *Public Notice* in the above-referenced proceedings issued by the Wireless Telecommunications Bureau, International Bureau, Office of Engineering and Technology, and Office of Economics and Analytics (together the "Bureaus") inviting interested parties to supplement the record to address certain proposals for repurposing the 3.7-4.2 GHz band ("C-band").[2/] T-Mobile urges the Commission, in evaluating all proposals, to continue to focus on the primary objective in this proceeding – maximizing the amount of C-band spectrum available for next-generation wireless technologies while preserving, only as necessary, spectrum for satellite use to meet requirements that cannot be met by other means.

1/ T-Mobile USA, Inc. is a wholly-owned subsidiary of T-Mobile US, Inc., a publicly traded company.

2/ *See Wireless Telecommunications Bureau, International Bureau, Office of Engineering and Technology, and Office of Economics and Analytics Seek Focused Additional Comment in 3.7-4.2 GHz Band Proceeding*, Public Notice, DA 19-678 (rel. July 19, 2019) ("*Public Notice*").

I. INTRODUCTION AND SUMMARY

As the Commission and Bureaus recognize, repurposing the C-band for terrestrial use is critical to maintaining U.S. leadership in the next generation of wireless services, including fifth-generation ("5G") wireless technologies.[3/] T-Mobile therefore applauds the Bureaus' continuing efforts to evaluate how to achieve that goal and welcomes the opportunity to submit comments on the recent filings by: (i) ACA Connects – America's Communications Association, the Competitive Carriers Association, and Charter Communications, Inc. (collectively, the "ACA Connects Coalition"); (ii) AT&T; and (iii) the Wireless Internet Service Providers Association ("WISPA"), Google, and Microsoft.[4/]

The record demonstrates that there are multiple mechanisms by which the maximum amount of C-band spectrum can be made available for terrestrial use. T-Mobile, for instance, has proposed that the Commission employ its incentive auction authority to convert the entire C-band, up to 500 megahertz, for terrestrial use where it is not required for satellite operations.[5/]

3/ *See Expanding Flexible Use of the 3.7 to 4.2 GHz Band*, Order and Notice of Proposed Rulemaking, 33 FCC Rcd 6915, ¶ 1 (2018) ("*NPRM*"); *International Bureau and Wireless Telecommunications Bureau Seek Focused Additional Comment in the 3.7-4.2 GHz Band Proceeding*, Public Notice, DA 19-385, at 1 (rel. May 3, 2019).

4/ *See* Letter from Ross Lieberman, Senior Vice President, Government Affairs, ACA Connects – America's Communications Association, *et al*., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed July 2, 2019) ("ACA Connects Coalition Proposal"); Letter from Henry G. Hultquist, Vice President, Federal Regulatory, AT&T Services, Inc., to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed May 23, 2019) ("AT&T Proposal"); Letter from Claude Aiken, President & CEO, WISPA, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed July 15, 2019) ("WISPA/Google/Microsoft *Ex Parte* Letter"); Reed Engineering, *3.7-4.2 GHz FCC and Fixed Wireless Access Co-channel Coexistence Study* (July 2019) ("Reed Study"), *attached to* WISPA/Google/Microsoft *Ex Parte* Letter.

5/ *See* Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 1-2 (filed July 3, 2019) ("T-Mobile Comments"); Letter from Steve B. Sharkey, Vice President, Government Affairs, Technology and Engineering Policy, T-Mobile USA, Inc., to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 13 (filed July 12, 2019) ("T-Mobile July 12 *Ex Parte* Letter").

Similarly, the ACA Connects Coalition proposes to make at least 370 megahertz of C-band spectrum available for terrestrial use and that this should be viewed as a nationwide spectrum floor, not a ceiling. Like T-Mobile, the ACA Connects Coalition also recognizes that fiber is an effective and reliable alternative transmission media for incumbent earth station users. T-Mobile agrees and suggests that greater use of fiber and other alternative transmission mechanisms could free up more than 370 megahertz of C-band spectrum for terrestrial wireless use. Moreover, any remaining satellite use in the C-band could be repacked in a segment of the band and consolidated in less densely populated areas, ensuring the availability of more C-band spectrum in dense urban areas where fiber alternatives to satellite service are plentiful and promoting additional fiber capacity in areas where broadband capacity may be limited today. Expanding the availability of fiber into rural areas will also expand broadband opportunities more broadly in underserved areas.

AT&T similarly recognizes the importance of clearing as much C-band spectrum as possible for terrestrial operations and minimizing any unnecessary protection of continued satellite operations to the greatest extent feasible.[6/] T-Mobile agrees with AT&T that the protection proposed by the C-Band Alliance ("CBA") is greater than necessary and the protection levels require further analysis. The Commission can incorporate many aspects of the ACA Connects Coalition's and AT&T's proposals in a Commission-led process that enables the Commission to clear the most spectrum for the lowest replacement cost solution, all while preserving incumbents' ability to receive content as they do today. However, the Commission

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6/ *See* AT&T Proposal at 2 (urging the Commission to "[d]esignate as unrestricted most of the spectrum reallocated for terrestrial mobile 5G use"); *see also* Letter from Michael P. Goggin, AT&T Services, Inc., to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 2 (filed July 16, 2019) ("The U.S. needs to make substantial amounts of mid-band spectrum available to maintain its lead in the race to 5G.").

should reject the proposal by WISPA, Google, and Microsoft to permit any new fixed wireless point-to-multipoint services in the C-band that could not otherwise be accommodated through now-standard flexible-use wireless authorizations.

II. THE ACA CONNECTS COALITION'S PROPOSAL IS BASED ON KEY FUNDAMENTAL PRINCIPLES

The Bureaus seek comment on the ACA Connects Coalition's proposal, which would make available at least 370 megahertz of C-band spectrum for flexible wireless use on a nationwide basis through a combination of transitioning certain earth station operators (*i.e.*, video programmers and multichannel video programming distributors ("MVPDs")) to fiber and repacking remaining "narrowband" earth station users (*e.g.*, radio and television broadcasters) in the upper portion of the C-band.[7/] The Bureaus ask how much spectrum could be cleared under this proposal and seek comment on mandatory relocation and repacking requirements that would use fiber delivery.[8/]

T-Mobile supports the premises of the ACA Connects Coalition's proposal. Recognizing that hundreds of megahertz of mid-band spectrum are necessary to satisfy the demand for 5G services, the ACA Connects Coalition's proposal would make available over twice as much spectrum for terrestrial use as the proposal submitted by the CBA.[9/] Equally as important, the ACA Connects Coalition's proposal acknowledges that use of C-band spectrum is not needed for

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7/ *See Public Notice* at 2-3; ACA Connects Coalition Proposal at 2-5.

8/ *See Public Notice* at 3-4.

9/ *See* Letter from Bill Tolpegin, Chief Executive Officer, C-Band Alliance, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, (filed June 12, 2019) ("CBA *Ex Parte* Letter"); Auctionomics, *White Paper – FUEL for 5G: Flexible Use and Efficient Licensing* (June 12, 2019) ("FUEL White Paper"), *attached to* CBA *Ex Parte* Letter.

a range of current applications – an acknowledgment now echoed by others.[10/] Finally, the proposal endorses the only legal and transparent method by which to select licensees for the band – an FCC-conducted auction.

A. The ACA Connects Coalition Appropriately Recognizes that its Proposal Should be Viewed as a Spectrum Floor and Not a Ceiling

The ACA Connects Coalition's proposal to make available at least 370 megahertz of C-band spectrum is a significant improvement over other plans, particularly the CBA's plan to make only 180 megahertz of C-band spectrum available for terrestrial use. The ACA Connects Coalition correctly observes that 370 megahertz of C-band spectrum for nationwide terrestrial use should be the minimum.[11/] T-Mobile strongly agrees, which is why it has favored an incentive auction that provides the potential to make the full 500 megahertz of C-band spectrum available for terrestrial use in some or all areas based on market demand.

Others agree that the Commission should make available as much mid-band spectrum as possible for terrestrial use if it seeks to maintain U.S. leadership in the race to 5G.[12/] As of the end of 2018, the U.S. was ranked sixth out of ten countries with respect to the availability of mid-band spectrum.[13/] And it risks falling behind as other countries continue to make significant

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10/ *See, e.g.*, Letter from Jason E. Rademacher and Christina Burrow, Cooley, Counsel for The Church of Jesus Christ of Latter-day Saints, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 7 (filed July 9, 2019) ("LDS *Ex Parte* Letter").

11/ *See* ACA Connects Coalition Proposal at 2.

12/ *See, e.g.*, Comments of ACA Connects – America's Communications Association, GN Docket No. 18-122, at 1-2 (filed July 3, 2019) ("ACA Comments"); Comments of Charter Communications, Inc., GN Docket No. 18-122, *et al*., at 2-3, 7 (filed July 3, 2019) ("Charter Comments"); Comments of Verizon, GN Docket No. 18-122, at 9-10 (filed Oct. 29, 2018) ("Verizon *NPRM* Comments"); Comments of Ericsson, GN Docket No. 18-122, at 10 (filed Oct. 29, 2018); Comments of Nokia, GN Docket No. 18-122, *et al.*, at 7 (filed Oct. 29, 2018).

13/ *See* Reply Comments of T-Mobile USA, Inc. ET Docket No. 18-295 and GN Docket No. 17-183, at 2 (filed Mar. 18, 2019) ("T-Mobile 6 GHz Reply Comments"); *see also* David Abecassis *et al., Global Race to 5G – Update*, ANALYSYS MASON, at 1 (Apr. 2019) ("Analysys Mason Report"), https://api.ctia.org/wp-content/uploads/2019/03/Global-Race-to-5G-Update.pdf ("[W]e have found that a

amounts of mid-band spectrum available.[14/] Indeed, several countries have already awarded mid-band spectrum specifically for the provision of 5G wireless services,[15/] including China, which is expected to release 500 megahertz of mid-band spectrum for 5G use.[16/] As U.S. Representative Gianforte and Senator Daines stressed, "to continue to lead the world in 5G deployment we need to clear as much spectrum as possible in a public auction."[17/] That is why the Commission should endorse the foundation of the ACA Connects Coalition's proposal and explore ways – as the ACA Connects Coalition recognizes it should – to make even more than 370 megahertz of C-band spectrum available for terrestrial operations nationwide.

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key short-term goal for the US to maintain its leading position is improving the availability of mid-band spectrum.").

14/ *See, e.g.*, Gabriela Mellow, *Nokia says Brazil 5G auction may be world's biggest yet*, REUTERS (Aug. 6, 2019), https://www.reuters.com/article/us-nokia-brazil/nokia-says-brazil-5g-auction-may-be-worlds-biggest-yet-idUSKCN1UW24Y ("Finnish telecoms equipment maker Nokia Oyj expects Brazil to host the world's biggest-ever single auction for fifth-generation (5G) spectrum next year . . . .").

15/ *See* Analysys Mason Report at 25 (demonstrating that several countries have awarded over 100 megahertz of mid-band spectrum to mobile and others (*e.g.*, China, Italy, and Spain) have awarded 300 megahertz or more, while the U.S. has awarded zero megahertz of mid-band spectrum); *Incentive Auction of Upper Microwave Flexible Use Service Licenses in the Upper 37 GHz, 39 GHz, and 47 GHz Bands for Next-Generation Wireless Services; Notice and Filing Requirements, Minimum Opening Bids, Upfront Payments, and Other Procedures for Auction 103; Bidding in Auction 103 Scheduled to Begin December 10, 2019*, Public Notice, FCC 19-63 (rel. July 11, 2019) (Statement of Commissioner Rosenworcel) (stating that "[s]ixteen countries have already auctioned spectrum specifically for the provision of 5G wireless services" and that "[e]very country on this list has made mid-band spectrum available for their early 5G deployments").

16/ *See* Analysys Mason Report at 25; David Abecassis *et al.*, *Final report for CTIA Mid-band spectrum global update*, ANALYSYS MASON (Nov. 2018), https://api.ctia.org/wp-content/uploads/2018/12/Analysys-Mason-Mid-Band-Spectrum-Global-Update.pdf ("500 MHz (3.3–3.6 GHz and 4.8–5.0 GHz) will be released in China."); EY, *China is Poised to Win the 5G Race*, at 29 (2018), https://www.ey.com/Publication/vwLUAssets/ey-china-is-poised-to-win-the-5g-race-en/$FILE/ey-china-is-poised-to-win-the-5g-race-en.pdf ("As a step to promote the development of 5G, China's MIIT has officially reserved a contiguous 500 MHz spectrum across the 3.3-3.6 GHz and 4.8-5 GHz bands for 5G services, with 100 MHz restricted for indoor use.").

17/ Letter from Greg Gianforte, U.S. Representative, and Steve Daines, U.S. Senator, to the Hon. Ajit Pai, Chairman, FCC, at 1 (dated July 25, 2019) ("Gianforte Letter"); *see also* Letter from John Kennedy, U.S. Senator, to President Donald Trump, at 1 (dated July 18, 2019) ("Kennedy Letter") ("The foreign satellite companies have been working to limit the amount of spectrum being made available for 5G to less than half the amount of mid-band spectrum being devoted to 5G by China.").

B. Greater Use of Fiber and Other Alternatives Can Help Bridge the Gap Between the 370 Megahertz Floor and 500 Megahertz Goal

(1) Earth Station Operators Can Make More Use of Fiber and Other Alternatives

The ACA Connects Coalition's proposal for a 370-megahertz spectrum floor is premised on moving incumbents – specifically MVPDs and video programmers, which occupy approximately 70 percent of the C-band – to fiber.[18/] As T-Mobile has demonstrated, fiber deployment can be an important key to enabling the conversion of C-band spectrum to terrestrial use.[19/] Fiber can provide an effective and reliable alternative to the delivery of content, and substantial fiber runs are already available in both urban and rural areas. Moreover, the cost to connect earth stations to fiber would only be a fraction of the potential value of the C-band.[20/]

[18/] *See* ACA Connects Coalition Proposal at 2-4; Letter from Ross Lieberman, Senior Vice President, Government Affairs, ACA Connects – America's Communications Association, *et al.*, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed July 9, 2019) ("ACA July 9 *Ex Parte* Letter"); Cartesian, *C-band Spectrum Clearing Plan*, at 5 (July 8, 2019) ("Cartesian Study"), *attached to* ACA July 9 *Ex Parte* Letter. The ACA Connects Coalition also stated that it intends to supplement the record to "further detail how the fiber network would be designed, established, launched, maintained, and paid for, particularly the part of the network that connects programmers to data centers" and that "the network would provide the MVPD industry with the same or better reliability than what they receive from satellite providers via the C-band." Letter from Ross Lieberman, Senior Vice President, Government Affairs, ACA Connects – America's Communications Association, *et al.*, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 1 (filed Aug. 6, 2019).

[19/] *See generally* Letter from Steve B. Sharkey, Vice President, Government Affairs, Technology and Engineering Policy, T-Mobile, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed June 21, 2019) ("T-Mobile June 21 *Ex Parte* Letter"). T-Mobile, however, recognizes that a different approach may be required for areas such as Alaska where unique geographic conditions and challenges have resulted in the "lack of availability of other distribution methods." Letter from Jessica DeSimone Gyllstrom, Telecommunications Law Professionals PLLC, Counsel to GCI Communication Corp., to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 2 (filed July 18, 2019); *see also GCI Communication Corp.; Request for Waiver of the Temporary Freeze on Applications for New or Modified Fixed Satellite Service Earth Stations in the 3.7-4.2 GHz Band*, Order, DA 19-725 (rel. Aug. 1, 2019) (finding that there is good cause to grant GCI Communication Corp.'s request for waiver because of the unique operational conditions in remote western Alaska and lack of viable alternatives); *Alaska Communications Internet LLC; Request for Waiver of the Temporary Freeze on Applications for New or Modified Fixed Satellite Service Earth Stations in the 3.7-4.2 GHz Band*, Order, DA 19-726 (rel. Aug. 1, 2019).

[20/] *See* Reply Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 7-10 (filed July 18, 2019) ("T-Mobile Reply Comments") (explaining that using conservative metrics, fiber is available to

Fiber is widely deployed today and offers a comparable and cost-effective means for the delivery of content.[21/] The Fiber Broadband Association, for example, has highlighted that "all-fiber networks provide virtually unlimited performance and are highly reliable and future-proof."[22/] And, as T-Mobile and others have pointed out, additional fiber deployment will promote enhanced connectivity in unserved and underserved areas.[23/]

While the ACA Connects Coalition recognizes the importance of fiber as an alternative transmission media, it suggests that as much as 130 megahertz of C-band spectrum may be necessary "to accommodate C-band narrowband customers who may wish to continue to need satellite service in the C-band."[24/] T-Mobile appreciates the need to ensure that all C-band customers and earth station users are "made whole."[25/] But "made whole" should be interpreted to mean that they are able to continue to reliably distribute content or services, not that continued access to C-band is necessary. As T-Mobile has demonstrated,[26/] fiber and other alternatives are feasible, cost-effective alternatives to C-band satellite use, and expanding access to these alternatives will allow even more C-band spectrum to be freed for terrestrial wireless use.

First, fiber (including redundant fiber) can be used to accommodate the operations of non-MVPD narrowband users for whom the ACA Connects Coalition would reserve C-band

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earth station sites in 90 percent of urban locations and in 70 percent of rural locations); T-Mobile June 21 *Ex Parte* Letter at 2-3.

21/ *See, e.g.*, ACA Comments at 2, 7-8; Charter Comments at 9-10; LDS *Ex Parte* Letter at 7.

22/ Letter from Lisa R. Youngers, President and CEO, Fiber Broadband Association, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 1 (filed July 26, 2019) ("FBA *Ex Parte* Letter") (adding that "all-fiber network providers offer Service Level Agreements and multi-path connectivity that ensure the level of redundancy that video program delivery requires").

23/ *See* T-Mobile Reply Comments at 8.

24/ ACA Connects Coalition Proposal at 3.

25/ *See id.* at 2.

26/ *See generally* T-Mobile June 21 *Ex Parte* Letter.

capacity. Some broadcasters use fiber today for a portion of their content delivery.[27/] And others have stated that they would be willing to relocate to fiber for the delivery of their content, recognizing, in particular, the benefits of fiber in closing the digital divide and other socioeconomic advantages.[28/] Those parties understand that the long-term prospects for use of the C-band for video distribution are doubtful and that greater investment in fiber could not only serve their needs, but also benefit unserved communities.[29/] As the ACA Connects Coalition and its members observe, a transition to fiber will be "seamless and fast" and provide a "future proof" delivery mechanism that is a "worthwhile investment."[30/]

Second, there are several other spectrum bands and means by which to deliver the content of non-MVPD narrowband users. Non-MVPD narrowband users may, for instance, utilize the Ku-band, Ka-band, and/or 3.5 GHz band for their content delivery.[31/] As The Church of Jesus Christ of Latter-day Saints notes, the Ku-band is an attractive option because "Ku-band receive-only earth stations are smaller and less expensive than comparable C-band stations" and can be

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27/ *See, e.g.*, Comments of BYU Broadcasting, GN Docket No. 18-122, *et al.*, at 14 (filed July 3, 2019) ("BYUB Comments") (acknowledging that "Brigham Young University's sports facilities are connected to BYUB's C-band uplinks via fiber"); Letter from Stephen Diaz Gavin, Rimon Law, Counsel to PSSI Global, L.L.C., to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at Attachment at 2 (filed Feb. 22, 2019) ("PSSI International Teleport (PIT) is now fully in-network with AT&T, which means we can utilize AT&T's expansive fiber network to offer worldwide connectivity through PIT.").

28/ *See, e.g.*, LDS *Ex Parte* Letter at 4-5, 7.

29/ *See id.* at 4-5; *see also* FBA *Ex Parte* Letter at 2 ("Not only would these fiber networks facilitate and enhance video programming delivery, but they would serve as a foundation for consumers in rural areas to have access to higher performance broadband service, 5G wireless service, and numerous other advanced services that are fundamental to the future of rural areas and are dependent on fiber as core infrastructure.").

30/ *See* ACA Connects Coalition Proposal at 2; Charter Comments at 9-10.

31/ *See* Verizon *NPRM* Comments at 12-13; Reply Comments of CTIA, GN Docket No. 18-122, *et al.*, at 8-10 (filed Dec. 11, 2018) ("CTIA *NPRM* Reply Comments"); Reply Comments of Google, GN Docket No. 18-122, *et al.*, at 16 (filed Dec. 11, 2018).

fully integrated without diminishing operations.[32/] Non-MVPD narrowband users also have the option to utilize bonded terrestrial wireless channels to provide their content. Some broadcasters, for example, have used 3G/4G bonded uplinks to provide live news and event coverage.[33/] The transition to 5G will make terrestrial wireless a more attractive and economically feasible alternative.[34/]

Third, fiber is a cost-effective alternative compared to maintaining satellite delivery. ACA estimates repacking and satellite launch costs to maintain service for non-MVPD users to be $3-4 billion.[35/] This is significantly greater than the approximately $1 billion estimate to connect all earth station locations to fiber found in the Roberson study.[36/] The public interest would be far better served by recouping these funds for public benefit rather than paying to unnecessarily revamp and maintain satellite capacity.

(2) A More Refined Assessment of Satellite Spectrum Needs Will Make Available Additional Spectrum

Even if non-MVPD narrowband users require a portion of the C-band to continue their services, it is likely, as the ACA Connects Coalition recognizes, that those needs will not require

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32/ LDS *Ex Parte* Letter at 6 (pointing out that the Ku-band is often the preferred option in other countries).

33/ *See* LiveU, The LiveU Family of Products, https://www.liveu.tv/products (last visited July 25, 2019) ("With LiveU's complete family of 3G/4G bonded uplink products, more options are available for live news and event coverage."); LiveU, *LiveU Announces $20m Multi-Year Deal with Sinclair Broadcast Group* (Jan. 14, 2019) (announcing that Sinclair Broadcast Group entered into an agreement with LiveU to upgrade its transmission units "for its newsgathering operations, ensuring the media company always has the latest bonded IP technology").

34/ *See* LiveU, 5G Ready, https://www.liveu.tv/solutions/5g (last visited July 25, 2019) (explaining that "[a]ll LiveU products are 5G ready, designed to work effectively with 5G networks" and that "IP first, IP-centric, high speed wireless networks will enable us to continue to develop even more classes of features, new types of devices and even longer battery life, lower delays and higher quality at higher resolutions in collaboration with our customers").

35/ *See* Cartesian Study at 10.

36/ *See* T-Mobile June 21 *Ex Parte* Letter at 1-2.

the designation of 130 megahertz of spectrum for satellite operations. The ACA Connects Coalition explains that its proposal is "conservative" and that its estimate of 100 transponders, translating to a total of 130 megahertz of spectrum, does not account for the intensiveness of current transponder use (*e.g.*, constant or intermittent).[37/] It correctly observes that such factors "will allow for the relaxation of these conservative assumptions."[38/] T-Mobile agrees that it is likely that far fewer transponders will be necessary to accommodate non-MVPD narrowband users. In addition, different types of non-MVPD narrowband users in the C-band may have different bandwidth needs and ability to relocate, likely reducing any necessary set-aside even further.

(3) Reservation of Any C-Band Spectrum on a Nationwide Basis is Unnecessary

Moreover, if some C-band spectrum is retained for satellite use because fiber or other spectrum may not be an effective alternative, that spectrum need not be reserved on a nationwide basis. Not reserving spectrum on a nationwide basis for satellite operations means the Commission could auction some spectrum (370 megahertz or more) on an unencumbered nationwide basis, while a limited amount of spectrum (130 megahertz or less) could be auctioned subject to some shared use with satellites. For that shared spectrum, the Commission could, for example, require that remaining earth station users are not located in densely populated areas[39/] and designate by rule where those earth stations may be located.[40/] Or, it could direct the

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37/ ACA Connects Coalition Proposal at 3.

38/ *Id*.

39/ *See* Letter from Steve B. Sharkey, Vice President, Government Affairs Technology and Engineering Policy, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 17-183 and GN Docket No. 18-122, at 2-3 (filed June 15, 2018) ("[R]relocating earth stations outside of urban areas will reduce the likelihood of interference to mobile services and *vice versa*."); T-Mobile July 12 *Ex Parte* Letter at 13.

40/ *See Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014, ¶ 54 (2016) ("*2016 Spectrum Frontiers*

consolidation of earth station hubs or earth station farms in certain geographic areas or, as the ACA Connects Coalition proposes,[41/] the utilization of data centers. Aggregating satellite operations into a limited number of discrete geographic locations would be more efficient than allowing satellite operators to deploy at random points throughout the United States. Concentrating satellite deployments would allow for terrestrial 5G deployment across the full 500 megahertz of spectrum available in the C-band while preserving satellite capabilities where redundant fiber and microwave connectivity may not be available. Any of these or similar approaches would permit the Commission to auction nearly all of the C-band spectrum on an unencumbered nationwide basis, making the limited amount of C-band spectrum that continues to be designated for satellite use also available for terrestrial operations in high-value areas, but subject to well-defined earth station rights in limited geographic areas.

These approaches would recognize the value in repurposing the *entire* C-band and focus on utilizing and investing in advanced alternative technologies to accommodate all incumbents, rather than investing unnecessary resources in satellite operations, including potentially requiring the construction, launch, and maintenance of additional satellites.[42/] T-Mobile agrees with AT&T that "[b]y freeing the majority of terrestrial licenses from coordination obligations, the

Order") (requiring, among other conditions, that an earth station's protection zone together with the protection zones of other earth stations in the same county do not, in the aggregate, cover more than 0.1 percent of the population of the county and that an earth station's protection zone does not infringe upon any major event venue, arterial street, interstate or U.S. highway, urban mass transit route, passenger railroad, or cruise ship port).

41/ *See* ACA Connects Coalition Proposal at 4; Cartesian Study at 8.

42/ *See* T-Mobile Reply Comments at 7-10; T-Mobile June 21 *Ex Parte* Letter at 2-5.

utility of the spectrum for mobile 5G deployments is enhanced, which will in turn increase license value and the potential revenues available to make the entire reallocation plan work."[43/]

C. The ACA Connects Coalition is Correct that Any Decision to Repurpose C-Band Spectrum Must Include an FCC-Led Auction

The ACA Connects Coalition proposes awarding C-band spectrum through either a conventional or incentive auction that is open to all bidders.[44/] T-Mobile supports this approach, and commenters agree that a Commission-led process is preferable to a secret transaction that directs all financial gains to satellite companies, as the CBA proposes.[45/] Indeed, U.S. Representative Gianforte and Senator Daines recently urged the Commission to "adopt an approach that will reallocate as much spectrum possible through an open, transparent FCC-led public auction" because "[a]n FCC-led public auction provides the necessary assurances to all interested parties that the relevant decisions and determinations regarding the assignment of 5G licenses in the C-band will be conducted through a traditional public process that offers transparency and equal opportunity."[46/]

T-Mobile previously explained that an incentive auction for the C-band would best serve the public interest. Not only would a C-band incentive auction take into consideration the rights of both incumbent satellite space station operators and earth station operators, but it would also ensure that new terrestrial licenses are distributed fairly in an open, transparent and market-based process and return substantial value to U.S. taxpayers from this public resource.[47/] The Commission should also permit licensees to engage in post-auction clearing negotiations to

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43/ AT&T Proposal at 4.

44/ *See* ACA Connects Coalition Proposal at 2, 5-7.

45/ *See* T-Mobile Reply Comments at 7.

46/ Gianforte Letter at 1; *see also* Kennedy Letter at 1.

47/ *See* T-Mobile Comments at 1-2.

encourage incumbents to transition more quickly from the C-band, as the Commission has permitted in other spectrum bands.[48/] This additional flexibility would allow the C-band to be made available for terrestrial use as quickly as possible, while still ensuring that the Commission can maintain its procedural safeguards over the auction process.

The Commission should not adopt – and, contrary to the Bureaus' assertion, the ACA Connects Coalition does not propose – an overlay auction for new terrestrial licenses in the C-band.[49/] An overlay auction – in which auction winners of terrestrial authorizations would be subject to potentially unlimited continued incumbent earth station operations – would create uncertainty and would compromise the ability to implement next-generation wireless services in the band.[50/] As noted above, to the extent a limited amount of C-band spectrum is needed to support remaining satellite operations, the Commission could still license that spectrum for terrestrial operations, subject to rules that permit earth stations to operate only in certain locations (and terrestrial licensees would be required to protect those earth station sites).

III. AT&T'S PROPOSAL RECOGNIZES THE IMPORTANCE OF CLEARING THE C-BAND AND WARRANTS ADDITIONAL EVALUATION

The Bureaus seek comment on the technical issues raised by AT&T's proposal, which recommends dividing the C-band into three segments: (i) an "unrestricted" segment for terrestrial mobile use; (ii) a segment reserved for Fixed Satellite Service ("FSS") use; (iii) and a segment in between for "Adjacent Licenses," where terrestrial users would be required to operate

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48/ *See* Letter from Russell H. Fox, Mintz, Counsel to T-Mobile USA, Inc., to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at 9-10 (filed Mar. 5, 2019).

49/ *See Public Notice* at 2.

50/ *See* Comments of T-Mobile USA, Inc., GN Docket No. 18-122, *et al.*, at 15-16 (filed Oct. 29, 2018) ("T-Mobile *NPRM* Comments") ("An overlay auction presumes what the Commission recognizes is not feasible – that FSS and terrestrial use can occur on the same frequencies in the same geographic area.").

either using lower power (or subject to other constraints) or subject to coordination obligations with nearby FSS earth stations.[51/] The Bureaus ask about the appropriate interference thresholds and protection criteria for in-band and adjacent-band FSS earth stations, including information on the transmit power limits and out-of-band ("OOB") emission limits for terrestrial base stations and end user devices.[52/]

Many aspects of AT&T's proposal merit favorable consideration in redesignating the C-band for terrestrial use, most notably its recognition of the importance of clearing as much C-band spectrum as possible for terrestrial operations.[53/] But T-Mobile agrees with AT&T that if the Commission seeks to adopt elements of AT&T's proposal, it must further develop the record to validate, among other things, the protection thresholds for earth stations, the ability of 5G networks to meet the proposed emissions criteria, and the performance of satellite receive filters.[54/] T-Mobile also agrees with AT&T that the Commission cannot rely on the CBA's proposed in-band and OOB protection thresholds, which would "impose significant architectural constraints on 5G deployments," forcing 5G deployment to significantly deviate from natural, organic network architecture growth plans.[55/] AT&T demonstrates that the CBA's proposal could be enhanced to achieve greater spectrum efficiency.[56/]

51/ *See Public Notice* at 4-5; AT&T Proposal at 2, 5.

52/ *See Public Notice* at 5.

53/ *See* AT&T Proposal at 3 ("AT&T now believes the technical provisions of CBA's proposal can be optimized to create even better spectrum efficiency by allowing some terrestrial use of ***all*** of the spectrum not retained for FSS use, impose fewer burdens on terrestrial mobile licensees, and avoid extraneous protection of FSS.").

54/ *See id.* at 17.

55/ *Id.* at 11.

56/ *See id.* at 6, 9.

(1) Adjacent-Band Protection

AT&T observes that if the Commission ultimately allocates less than 500 megahertz of C-band spectrum for terrestrial use, the Commission should "adopt rules to minimize harmful interference by terrestrial mobile 5G deployments to earth stations in adjacent FSS Spectrum,"[57/] including by repacking any remaining earth stations in the upper portion of the C-band.[58/] T-Mobile agrees. But as T-Mobile has stated above, instead of setting aside a portion of the repacked spectrum exclusively for satellite operations, any spectrum that remains available for satellite use should be shared geographically with terrestrial operations, which would simplify adjacent-band protection issues. However, if some portion of the C-band is designated exclusively for satellite use, T-Mobile agrees that the Commission should consider alternatives to the "extremely restrictive" user device OOB emissions limits proposed by the CBA.[59/]

The CBA's proposed limits for mobile devices are more restrictive than the limits the Commission adopted for the 3.5 GHz band, which are already significantly lower than other flexible-use bands, to protect the same type of satellite operations.[60/] Further, the CBA's proposed limits are more stringent than the emissions levels that the CBA's member companies supported above the 3.5 GHz band – once again for the *exact same* satellite receivers.[61/] The CBA provides no support for why more stringent limits should be adopted for the C-band and ignores the impact that its proposal could have on equipment development.

57/ *Id.* at 3.

58/ *See id.* at 12-13.

59/ *See id.* at 16-17.

60/ *See* T-Mobile 6 GHz Reply Comments at 4; Comments of T-Mobile USA, Inc., GN Docket No. 17-186, at 10-11 (filed Oct. 2, 2018).

61/ *See* Joint Reply Comments of Intelsat License LLC and SES Americom, Inc., GN Docket No. 17-258, at 2 (filed Jan. 29, 2018).

T-Mobile notes that, in the United Kingdom, there are terrestrial and satellite operations in adjacent bands – terrestrial operations in the 3.4-3.8 GHz band and satellite operations in the 3.8-4.2 GHz band.[62/] Recognizing that the 3.4-3.8 GHz band is "a key frequency band for 5G services in the UK,"[63/] Ofcom has raised the terminal power limits to enable 4G and 5G systems in the 3.4-3.8 GHz band.[64/] In addition, Ofcom adopted base station OOB emissions limits to protect satellite operations in the 3.8-4.2 GHz band that are significantly less stringent than the limits proposed by the CBA.[65/] If the Commission reserves any spectrum for satellite operations, it should consider Ofcom's assessment of these issues. Any OOB emissions limits the Commission adopts should seek to promote the deployment of 5G services and global harmonization, not hinder it.

While T-Mobile agrees with AT&T that the Commission should not permit some C-band spectrum to serve as fallow guard bands as the CBA proposes,[66/] the Commission should also

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62/ *See Variation of Spectrum Access licences in the 3400 to 3680 MHz band: Ofcom's consideration of the requests to align the technical conditions of certain 3.4 GHz, 3.5 GHz and 3.6 GHz Spectrum Access licences with European Commission Decision 2019/235*, OFCOM (Apr. 18, 2019), https://www.ofcom.org.uk/__data/assets/pdf_file/0025/144880/notice-proposal-vary-3.4-ghz-radio-spectrum-licences.pdf.

63/ *See id.* at 5.

64/ *See id.* at 4-7. T-Mobile notes that Ofcom adopted terminal power limits in terms of Total Radiated Power instead of the traditionally used Effective Isotropic Radiated Power in order to accommodate Active Antenna Systems, which have not yet been fully developed and implemented. *See id.* at 5.

65/ *See* Letter from Jennifer D. Hindin, Wiley Rein LLP, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122, at Attachment at 15 (filed Mar. 4, 2019); *see also* Electronic Communications Committee, *ECC Report 281: Analysis of the suitability of the regulatory technical conditions for 5G MFCN operation in the 3400-3800 MHz band*, at 37, July 6, 2018, https://www.ecodocdb.dk/download/5ffb56c9-9c78/ECCRep281.pdf. The baseline power limits adopted by Ofcom are: 14 dBm/MHz in the first 5 megahertz; 8 dBm/MHz in the next 5 megahertz; 6 dBm/MHz in the next 30 megahertz; and -9 dBm/MHz after that. In contrast, the CBA's proposal requires a 20 megahertz guard band so that the EIRP can be -22 dBm/MHz in the first 20 megahertz of the satellite band and -32 dBm/MHz after that.

66/ AT&T Proposal at 4, 5.

consider the limited utility that would occur if some portion of the C-band is set-aside for lower-powered "Adjacent Licenses" as AT&T has proposed.[67/] This approach would involve calculations regarding interference metrics, coordination procedures, and the relative technical capabilities of 5G terrestrial networks and satellite earth stations that, as AT&T acknowledges, will require further evaluation.[68/] Moreover, 5G operations are expected to involve full-power operations, and this is true around the world, meaning that lower-powered Adjacent Licenses would be inconsistent with the international approach to 5G. As noted above, the Commission has already diminished the utility of the 3.5 GHz band for 5G operations by adopting transmit power levels for the spectrum that are significantly lower than in other flexible-use bands.[69/] Although the Commission's actions at 3.5 GHz may have been justified in that proceeding, the Commission has appropriately recognized that it should not take the same approach with respect to other key mid-band spectrum, proposing full-power limits for both base stations and mobile devices in the C-band. T-Mobile supports this approach.

(2) In-Band Protection

T-Mobile agrees with AT&T that the Commission should consider alternative protection of earth station locations rather than the overly conservative protection zones across a 150-meter radius around those locations.[70/] Terrestrial mobile operations can operate more closely to earth

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67/ *See id.* at 2.

68/ *See id.* at 5 ("The size of the Adjacent Licenses block will depend on the [out-of-band] emissions protection levels ultimately adopted as well as the performance of base station filters used by terrestrial networks and the receive filters installed by FSS users. Hence, AT&T recommends that the Commission seek additional vendor input to fine tune this proposal.").

69/ *See* T-Mobile 6 GHz Reply Comments at 4; Comments of T-Mobile USA, Inc., GN Docket No. 17-186, at 10-11 (filed Oct. 2, 2018).

70/ *See* AT&T Proposal at 17. T-Mobile also agrees with AT&T that the Commission should further evaluate the large 150-kilometer coordination zones for earth stations that would remain in the portion of the C-band reallocated for terrestrial mobile operations as proposed by the CBA. *See id.*

stations than the CBA suggests without creating harmful interference. Taking into consideration the reference filter considered by the CBA, which provides 43 dB of rejection, the power at the inputs to the filter can be -38.6 dBm/MHz (-81.6 dBm/MHz protection threshold at the output of the filter + 43 dB filter rejection = -38.6 dBm/MHz at the inputs to the filter).[71/] Using free space path loss and the reference earth station antenna pattern suggested by the CBA,[72/] when a 5G base station is boresight-to-boresight with an earth station antenna (defined as within 1.5 degrees of the earth station pointing angle), the required separation distance would be 950 meters.[73/] And with just a 1.6 degree angle offset, this distance would be reduced to 35 meters. These simple calculations demonstrate that there are much more efficient ways to protect earth stations than using the 150-meter radius proposed by the CBA.

T-Mobile agrees with AT&T that the earth station filter assumed by the CBA may not be "state-of-the-art."[74/] Because potential in-band interference can be partially mitigated by an earth station receive filter,[75/] the Commission should investigate whether satellite operators can deploy higher-performing earth station filters than what the CBA contemplates earth station operators will use.

71/ *See* Reply Comments of the C-Band Alliance, GN Docket No. 18-122, *et al.*, at Technical Annex at 16 (filed Dec. 7, 2018) ("CBA Reply Comments").

72/ *See* CBA Reply Comments at Technical Annex at 3.

73/ If protection is required for all earth stations within a 150-meter radius as the CBA has proposed, then the maximum separation distance would be 1100 meters.

74/ *See* AT&T Proposal at 17.

75/ *See id.* at 6.

IV. C-BAND SPECTRUM SHOULD NOT BE DESIGNATED FOR FIXED WIRELESS POINT-TO-MULTIPOINT SERVICES SHARED WITH SATELLITE OPERATIONS

The Bureaus seek comment on the study submitted by WISPA, Google, and Microsoft, which analyzed the co-existence between satellite and fixed wireless point-to-multipoint ("P2MP") broadband systems and suggests that exclusion zones of about 10 kilometers are sufficient to protect most earth stations from harmful interference caused by "properly-engineered" co-channel point-to-multipoint broadband systems.[76/] The Bureaus seek comment on ways to increase efficient shared use of the C-band and ask whether it is possible to achieve the short-term sharing goals of the various proposals.[77/]

As T-Mobile has repeatedly stated, there is no reason for the Commission to designate a portion of the C-band exclusively for fixed wireless broadband P2MP service shared with satellite operations.[78/] The principal goal of this proceeding should be to maximize the amount of spectrum to be repurposed for terrestrial services in general. Those terrestrial services can be licensed on a flexible-use basis, and auction winners can choose the type of service they wish to offer – including fixed wireless broadband P2MP service.[79/] Designating a portion of the band for a particular type of terrestrial service is contrary to the Commission's current practice of permitting any type of service that conforms to applicable technical rules.[80/] In recent actions,

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76/ *See Public Notice* at 5; WISPA/Google/Microsoft *Ex Parte* Letter at 1-2.

77/ *See Public Notice* at 4-5.

78/ *See* T-Mobile *NPRM* Comments at 20-22.

79/ *See also* Comments of CTIA, GN Docket No. 18-122, *et al.*, at 26 (filed Oct. 29, 2018) ("CTIA *NPRM* Comments").

80/ *See, e.g., 2016 Spectrum Frontiers Order* ¶ 4 ("In order to meet our statutory duty to ensure that spectrum is being placed in use, we adopt performance requirements that are flexible to allow multiple use cases to evolve over time.").

Congress has also directed the Commission to make terrestrial spectrum available on a *flexible* basis.[81/] Doing otherwise here would contravene a clear congressional directive.

Designating spectrum specifically for P2MP and satellite shared use would also be bad spectrum policy. As others in this proceeding have observed, authorizing P2MP fixed service in the C-band could make it more difficult to repack existing users of the spectrum, which would undermine the goal of maximizing the amount of C-band spectrum to be repurposed for 5G.[82/] In addition, designating spectrum specifically for P2MP fixed service shared with satellite operations in the C-band could create interference risks and technical impediments that limit use of the spectrum as well as result in further encumbrances that may hinder any future repurposing of the band.[83/]

In addition, the record demonstrates that there are several other opportunities for P2MP service in the near term.[84/] The adjacent Citizens Broadband Radio Service band, for example, will provide spectrum that permits P2MP use.[85/] Other spectrum bands, including TV white spaces, the 2.5 GHz band, 4.9 GHz band, and 6 GHz band are also well suited for P2MP services. These bands represent better options if the Commission wishes to optimize spectrum for P2MP operations in particular as they do not involve the types of incumbency issues that are

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81/ *See, e.g.*, Spectrum Pipeline Act of 2015, Pub. L. No. 114-74, § 1004, 129 Stat. 621 (2015) (requiring the Commission auction and grant new licenses for certain spectrum "subject to flexible-use service rules").

82/ *See* CTIA *NPRM* Comments at 25-26.

83/ *See* CTIA *NPRM* Reply Comments at 11; Reply Comments of the Satellite Industry Association, GN Docket No. 18-122, at 2-3 (filed July 18, 2019) ("SIA Reply Comments").

84/ *See, e.g.*, CTIA *NPRM* Comments at 26; CTIA *NPRM* Reply Comments at 12; SIA Reply Comments at 3 (adding that "[w]ireless internet service providers ('WISPs') already have access to more than 10 gigahertz of licensed and unlicensed spectrum, which includes a substantial amount of mid-band spectrum").

85/ CTIA *NPRM* Reply Comments at 12; SIA Reply Comments at 3.

present in the C-band and do not represent the same opportunity for a large swath of critical mid-band spectrum for next-generation wireless services as the C-band does.

V. CONCLUSION

As consumer demand for next-generation wireless services continues to grow, the Commission must make available as much C-band spectrum as possible for terrestrial use. The Bureaus have sought comment on several proposals that generally seek to achieve that goal. The Commission and the Bureaus should implement aspects of those proposals that would enable as much of the 500 megahertz of C-band spectrum as possible to be licensed for terrestrial use. In areas where that is not feasible, any remaining satellite use of the C-band should be consolidated and limited.

Respectfully submitted,

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